

Digitization of Scientific Journals in Serbia

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Abstract

A digitization project in progress carried out by the Mathematical Institute of the Serbian Academy of Sciences, Belgrade (<http://www.mi.sanu.ac.yu>) and the Faculty of Mathematics, Belgrade (<http://www.matf.bg.ac.yu>) is described. The projects aim is to build a database and an electronic presentation of digitized scientific books and journals printed in Serbia, particularly in mathematical sciences (mathematics, mechanics, astronomy, computer science and physics) and to make them searchable and available in the full-text mode on the Internet.

Keywords: scientific journals; retro digitization; digital archives

1 Introduction

There is a number of mathematical and mathematically-related books and journals printed in Serbia. Some of the published works have been digitally created (usually in TeX and its versions) and more-or-less they are accessible using ordinary web browsers, while the others, mostly older papers, have been born in print and are harder to obtain. Thus, we have also started the process of retro digitization of these printed works to produce their digital images that can be read or printed. The main achievement of the project in last two years is complete retro digitization of two leading Serbian mathematical journals: *Publications de l'Institut Mathematique* and *Publications of the Faculty of Electrical Engineering – Series Mathematics and Physics*. Besides these two completely digitized journals, five Serbian journals in mathematics, teaching and computer science are stored in the database. Some of them, for example *NCD Review*, a journal on digitization technologies, founded in 2002, are presented completely, while the others are partially digitized, mainly from the beginning of nineties of the last century. All together, there are more than 4000 digitized articles having about 30000 pages. Digitized items are displayed at the virtual libraries: <http://alas.matf.bg.ac.yu/biblioteka/home.jsp>, <http://publication.mi.sanu.ac.yu>, <http://pefmth2.etf.bg.ac.yu/> and http://elib.mi.sanu.ac.yu/pages/browse_journals.php.

2 Serbian Mathematical Journals in Digital Archives

The journal *Publications de l'Institut Mathematique* is the oldest Serbian scientific journal in the field of mathematics established in the year 1932 under the name *Publications Mathematiques de l'Université de Belgrade*. It was founded with the help of two foundations of the Belgrade University foundations. Seven tomes were published until the World War II, the eighth tome was lost in the German bombing of Belgrade in April 6. 1941. Immediately after the founding of the Mathematical Institute in 1946, the publication of the journal was restarted in 1947 under the new name *Publications de l'Institut Mathematique*. More then 2000 articles were published in 102 volumes until these days. The scope of the journal in the beginning was broader, not only in mathematics, but articles referring to mechanics and astronomy were published in it as well. Most prominent Serbian and Yugoslav scientist in these fields published in the journal, including Đ. Kurepa, J. Karamata, M. Petrović, M. Milanković, A. Bilimović, J. Plemelj, S. Mardešić, and others. Some of the leading world mathematicians published in *Publications* as well: H. Lebesgues, P. Montel, P. Erdős, W. Sierpinski, S. Shelah, and others. Most papers in the journal are in English, but there are papers written in Russian, French, and German as well. The second journal, *Publications of the Faculty of Electrical Engineering – Series Mathematics and Physics*, was founded in the year 1956. In the beginning, each contribution appeared separately bound and numbered consecutively, several times a year. Since 1959, the issues have been appearing collected in one or more volumes per year. In the first years, the journal had contributions from different fields apart from Mathematics: Physics, Mechanics, and Electrical Engineering. Papers were written in the Serbian, French, Russian, German and English. In the course of time, the journal focused almost exclusively on Mathematics,

especially convexity, functional equations and differential equations, and English language became dominant. The digitized version of the journal contains about 1000 papers. Both journals are reviewed and indexed in: *Mathematical Reviews* (MR), *Zentralblatt Math* (ZBL) and Russian *Mathematical Surveys*.

3 Digital Objects and Metadata

The digital object in the virtual library usually consists of several components: digitized image of the manuscript, some graphic components, and metadata. We developed a particular data base and Internet oriented software for handling digitized journals. It relies on three types of metadata: descriptive, structural and administrative. Special data and services important for papers published in scientific journals were also included: keywords, scientific classification of AMS (American Mathematical Society classification), numbers of reviewer reports in MR and ZBL, DOI numbers, and statistics of accessing and downloading papers. Descriptive metadata follow data contained in librarian printed catalogs, i.e., they obey librarian standards. One problem was that old issues do not have standard descriptive tags such as ISSN numbers so to classify them we needed particular solutions. Structural data explain how the components of the digitized object are interconnected. Administrative data describe exactly how an item is preserved: resolution, rate of compression, file type containing the digitized image, etc. The success of digital preservation efforts will rest to a significant degree on the scope and reliability of the metadata records. For example, metadata made possible the asset-management systems that back up and periodically duplicate digital records. Cataloging information enable one to locate what they are looking for in the library. Metadata help to make various internet presentations. Therefore full repository system required tens of metadata elements for each digitized item. Building such database systems and populating them is very labor-intensive and expensive. Creating the table of keywords and assigning them to articles was particularly complicated and time-consuming job since it could be done only by scientists. Some trade off needed to be found. For resolving these issues, cooperation between institutions working in the field of digitization was very important, in particular exchange and agreement of metadata formats. Particular attention was given to standards. Scanning was performed in 300dpi, in tiff format. Papers were converted into pdf format and in this form they are accessible on Internet. As curiosity, let us mention that all issues of *Publications Publications de l'Institut Mathematique* between 1980 and 1990 are retyped in TeX, and all issues of this journal since 1980 are accessible in dvi format, as well.

4 Implementation

We decided to develop our own software instead of using commercial, or open source software. We decided so, since we wanted to lower the development and maintain cost, then because of future upgrading and integration it in larger information systems, such as virtual libraries of wider scope. The software supports all usual functions, browsing, searching under various criteria, examining and downloading papers. Since papers were written in several languages, we decided to keep the multilingual feature. Therefore, we have chosen MySQL server for a database as it supports UTF-8 encoding. The multilingual support is embedded into the model of data, so information related to the corresponding languages are saved. JAVA programming language is used in developing a web application for administering and searching the database, especially advanced features like JAVA beans and struts, which enable a high performance web application. Other technologies include PHP and Apache as a web server.

5 Conclusion

Digital archive of Serbian scientific journals will contribute significantly to the widespread accessibility of articles printed in these journals, particularly since they are obtainable on the web free of charge. One of the consequences will be the rise of scientific impacts of these journals and articles printed in them. A further plan assumes that our Virtual library will include once editions of all important Serbian scientific journals. It is difficult to estimate when this task will be finished, but a decade, we believe, is a good guess.

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